3.0 Site Buildings

3.1 Documents Supporting Building Decommissioning

In 2000, Westinghouse compiled a series of eight reports, identified as Report #001 through Report #008, that document all information necessary to demonstrate that the site buildings meet the radiological criteria for release for unrestricted use. These reports are included as attachments. Each of these reports is briefly described in the following sections.

3.1.1 Westinghouse Electric Corporation, 2000a, "Calibration Records for Instruments Used for Radiological Surveys, Westinghouse Electric Corporation, Blairsville, PA", Volumes 1 through 7, (Report #001)

Report #001 compiles information on the calibration of the radiological survey instruments, which were used to measure the radiation levels presented in the other reports issued for the building remediation project (Reports #002 through #008). In each report that documents a final radiological survey, the data sheets that record the measured radiation levels also provide specific information with respect to the specific instrument used to make the measurement. Report #001 provides the necessary information to establish the entire calibration history of each specific instrument. These instruments have been used for the Westinghouse site at Blairsville, and former Westinghouse Sites at Cheswick (now Curtiss-Wright Electro-Mechanical Corporation) and Forest Hills (now Viacom, Inc.). Therefore, calibration records presented in Report #001 are applicable to all of these sites.

3.1.2 Westinghouse Electric Corporation, 2000b "Summary of Floor Scan Measurements and Data Analysis, Westinghouse Electric Corporation, Blairsville, PA", (Report #002)

Report #002 compiles a summary of all the floor scan measurements taken of large areas of the floor. Such measurements were sufficiently sensitive to identify several small areas that showed elevated Beta and/or Gamma radiation activity. Each area identified was remediated and resurveyed as appropriate. The floor scan log and a site-sectioning map, which shows the section designations, are included in Appendix A of Report #002 for reference. Appendix B of Report #002 presents the original floor scan data for the site.

3.1.3 Westinghouse Electric Corporation, 2000c, "Diagrams and Data Sheets for Radiological Surveys of Buildings, Westinghouse Electric Corporation, Blairsville, PA", (Report #003)

Report #003 includes documents that compile all of the building diagrams, both site maps and individual survey section maps. Also included are all of the original radiological survey data sheets used in the final unconditional building release analysis.

3.1.4 Westinghouse Electric Corporation, 2000d, "Radiological Survey of Building Roofs, Westinghouse Electric Corporation, Blairsville, PA", (Report #004)

Report #004 compiles information on the roof surveys performed on Buildings 1 and 4 at the Blairsville site. This report includes the survey data sheets with the conversion of the results into units comparable with the acceptance criteria, statistical analysis of the survey data in order to determine if the radiological acceptance criteria have been met at the desired degree of confidence, a compiled statistics table, and data trend visualization plots.

3.1.5 Westinghouse Electric Corporation, 2000e, "Determination of Site Background Values for Radiological Measurements, Westinghouse Electric Corporation, Blairsville, PA", (Report #005)

Report #005 presents the results of measurements made to determine appropriate values for the background radiation levels using the various radiation detection instrumentation that were used for the building release surveys. Analytical information is also presented for soil samples taken. Radiation measurements were made on various surfaces both on and off the site. A statistical analysis is presented to evaluate the differences in the background measurements.

3.1.6 Westinghouse Electric Corporation, 2000f, "Summary Report on Information Relevant to the Radiological Survey of the Blairsville Specialty Metal Plant, Westinghouse Electric Corporation, Blairsville, PA", (Report #006).

Report #006 provides an overall summary of the project and final survey. Other reports have been prepared that provide specific information in detail. References are made throughout Report #006 to provide a roadmap to all relevant information. Where appropriate, sufficient information is included in Report #006 to provide a document that presents a complete overview of the final status of the site buildings. The individual reports referenced in Report #006 provide the detailed documentation necessary to justify the information contained therein.

3.1.7 Westinghouse Electric Corporation, 2000g, "Data Evaluation and Analysis for Radiological Surveys of Interior Building Surfaces, Westinghouse Electric Corporation, Blairsville, PA", (Report #007)

Report #007 contains all of the data related to the final radiological survey of the building interior surfaces along with the results of the statistical analysis of the data to demonstrate compliance with the applicable criteria. All of the data is presented in a tabular format and certain data is presented in a graphical format.

3.1.8 Westinghouse Electric Corporation, 2000h, "Radiological Analysis of Interior Trench Soil Data, Westinghouse Electric Corporation, Blairsville, PA", (Report #008)

Report #008 compiles interior soil data related to the removal of the underground pipes and sumps within the building. Included in this report are appropriate soil logs, diagrams, and analytical data sheets.

3.2 Radiological Remediation and FSS of Site Buildings

Westinghouse conducted radiological investigations and decommissioning activities in certain WSMP Buildings from 1994 to 2000 to address legacy issues associated with past manufacturing processes. The multi-building complex is shown on the site diagrams in Appendix A of Report #003. The four principle buildings that comprise the facility are summarized in Table 3-1.

Table 3-1: WSMP Buildings

Building Name	Building Number
Main Building	1
Westro Building	2
Zircaloy Building	3
Die Shop	4

Only Building 1 and a portion of Building 4 historically included operations that involved uranium. Buildings 2 and 3 were constructed after uranium operations ceased. However, a small area in Building 3 was used for storage of waste containers during the site remediation efforts. As such, Buildings 2 and 3 and portions of Building 4 can essentially be looked at as comparative background data as that was the purpose of including them in the survey plan. While FSS activities were conducted in each of the buildings, remediation activities were only required in Building 1.

3.2.1 Pipe Removal, Subfloor Soil Remediation, and Final Status - Building 1

An investigation was conducted to locate all of the potentially contaminated underground piping and associated sumps within Building 1. The investigation consisted of reviewing existing drawings, investigation of surface features on the floors and radiological surveys. Remediation of the underground piping and sumps occurred over an extended period due to the necessity to coordinate with the operational needs of the facility. As an area became available for remediation work, the piping and sumps were removed. If additional piping, not previously identified, was located during the remediation effort it was also removed. Each excavation was then surveyed using instrumentation such as NaI detectors and soil samples were taken. The location for soil sampling was based on those locations having the highest probability for contamination such as pipe joints and locations where pipes were cut to appropriate lengths. Backfilling of the excavations usually occurred soon afterwards without waiting for analytical results, due to the need to return each area to operational use. In general, the gamma surveys were sufficient to identify potential problems. However in a few cases, the final analytical results exceeded the release criteria of 30 pCi/g of total uranium (or the operational equivalent of 1 pCi/g of U-235). Overall

the surface area represented by excavations represented a small fraction of the total area beneath the plant floor.

Survey Unit I-39 represented a substantially different situation than the reminder of the plant. This area apparently housed a hot rolling mill on which depleted uranium metal fuel elements were manufactured. Rather than underground piping, this area was found to be a series of trenches and pits associated with the hot rolling mill. No drawings were available to indicate the original construction so the remediation effort consisted of excavating down to the various surfaces. This resulted in essentially exposing the entire original structure, which was subsequently filled in and covered over.

Report #008 compiles interior soil data related to the removal of the underground pipes and sumps within Building 1. Report #008 includes appropriate soil logs, diagrams, and analytical data sheets. As indicated in Report #008, all known underground piping and structures that were associated with the original process operations have been removed. Based on the analytical results for the soil samples (taken as closeout samples prior to closure of the excavation), the subsurface soil meets the criteria for unrestricted release. Although a few sections show elevated results, these areas are small relative to the entire plant and are now covered by the restored concrete floor. The eventual demolition of the building would be expected to result in substantial mixing of the subsurface soil such that the small areas of elevated activity could not result in any substantial risk to individuals.

3.2.2 FSS- Roofs – Buildings 1 and 4

Report #004 compiles information on the roof surveys performed on buildings 1 and 4 at the Blairsville site. Only the roofs of Buildings 1 and 4 were included in the roof survey because only Building 1 and Survey Unit 4-18-1 of Building 4 existed during the period of use of licensed materials. Included in Report #008 are the survey data sheets with the conversion of the results into units comparable with the acceptance criteria, statistical analysis of the survey data in order to determine if the radiological acceptance criteria have been met at the desired degree of confidence, a compiled statistics table, and data trend visualization plots.

Based on the radiological surveys of the roofs for Buildings 1 and 4, these roofs meet all applicable criteria for release for unrestricted use.

3.2.3 FSS Activities - Building Surfaces

Report #006 provides an overall summary of the building remediation project and final survey. Other Reports have been prepared that provide specific information in detail. References are made throughout Report #006 to provide a roadmap to all relevant information. Where appropriate, sufficient information is included in Report #006 to provide a document that presents a complete overview of the final status of the site buildings. The individual reports referenced in Report #006 provide the detailed documentation necessary to justify the information contained therein.

Report #006 provides the general information relative to the final radiological surveys of buildings. Refer to that report for the following information:

- Site Description
- Radiological Acceptance Criteria
- Survey Classification System
- Classification of Building Area
- Selection of Survey Instruments and Instrument Characterization
- System for Identification of Survey Point Locations
- Statistical Analysis of Survey Results
- Survey Protocol

Report #007 provides complete information on the results of the radiological surveys of the interior of the building surfaces, including a table of compiled statistics to demonstrate compliance with the acceptance criteria. In addition, Report #002 provides data on the floor scans conducted within the buildings, and Report #003 contains survey diagrams and the original survey data sheets containing the actual measured results.

The information presented in Report #006 and the accompanying reports demonstrates that the current condition of the buildings on the Blairsville site meet all of the radiological acceptance criteria at the desired degree of confidence and are therefore acceptable for unrestricted use.

3.3 Main Building (Building 1) Radiological Dose Assessment

The RESRAD-Build code was used to perform a dose analysis for the Building 1 (Survey Unit 1) to demonstrate that residual radiation that may be present is well below the dose-based release criterion of 25 mrem per year as required by 10 CFR 20, Subpart E. This section includes a model description, a discussion of model inputs, and presentation of results. Section 3.4 presents a sensitivity analysis.

3.3.1 Building Model Description

The RESRAD-Build computer program is a pathway analysis model designed to evaluate the potential radiological dose incurred by an individual who works or lives in a building contaminated with radioactive material (Yu, C and others, 2003). It considers releases of radionuclides into the indoor air by diffusion, mechanical removal, or erosion. The program uses an air quality model to evaluate the transport of radioactive material from one room or compartment to another.

The following seven exposure pathways are considered in the model:

1. External exposure directly from the source,
2. External exposure to materials deposited on the floor,
3. External exposure due to air submersion,
4. Inhalation of airborne radioactive particulates,
5. Inhalation of aerosol indoor radon progeny and tritiated water vapor,
6. Inadvertent ingestion of radioactive material directly from the source, and
7. Ingestion of materials deposited on the surfaces of building compartments.

Various exposure scenarios may be modeled in the RESRAD-Build code, including industrial worker, renovation worker, and residency scenarios. The exposure pathways included in the building occupancy and renovation scenarios are external exposure to penetrating radiation, inhalation of resuspended surface contamination, and inadvertent ingestion of surface contamination. Justification for eliminating other pathways is provided in NUREG/CR-5512, Volume 1.

RESRAD-Build has been widely accepted and has a large user base. The models used in the software were designed for and have been successfully applied at sites with relatively complex physical and contamination conditions. In addition, the software has been verified and validated (Yu, C. and Others, 1999, NUREG/CP-0163 [NRC, 1998]). Version 3.3 of RESRAD-Build was used in this analysis. This version has the capabilities of performing both deterministic and probabilistic dose assessments.

3.3.2 Exposure Scenarios

The potential future uses of a building must be considered before dose can be estimated. Potential future uses are referred to as exposure scenarios, and the two major exposure scenario categories are building occupancy and building renovation. Building occupancy scenarios consider residents, office workers, industrial workers and visitors. Building renovation scenarios consider decontamination workers, building renovation workers, and building demolition workers. Building occupancy scenarios typically involve long term chronic exposures, and renovation scenarios involve short-term exposures. For this analysis, one building occupancy scenario and two building renovation scenarios were considered. Considering that the property is likely to continue as an industrial facility, the industrial worker scenario was modeled along with the building renovation worker, and building demolition worker scenarios.

3.3.2.1 Occupancy Scenario – Industrial Worker

The building occupancy scenario was modeled to simulate light industrial use of a decontaminated building(s). To conduct a site-specific analysis for WSMP, input parameter values identified in the NUREG/CR-6755 data template file were used where appropriate in combination with site specific input values such as number of sources, source types, source locations, room area, and room height.

The building occupancy scenario for the Main Building accounts for both fixed and removable residual radioactivity on the floor, ceiling, lower walls, and upper walls. The screening group for the building occupancy scenario consists of adult males who work in light industry. They occupy and work in a commercial facility in a normal manner without deliberately disturbing sources of contamination. It is assumed that occupancy begins immediately after decommissioning and release of the building, and the people working in the facility may be exposed to residual contamination for one full year.

3.3.2.2 Renovation Scenario – Renovation Worker

Decontamination operations at the Blairsville Site have significantly reduced or eliminated removable sources of residual radioactive contamination. However, at some time in the future, buildings may require renovation. During these activities, surface sources will likely be disturbed and loose contamination may be released. Loose contamination can produce higher concentrations of radionuclides in the air or on surfaces than the levels in an undisturbed building.

The renovation worker scenario may involve work activities ranging from heavy construction to light finish work. Activities may include removal of a portion of a concrete structure that would create loose

surface contamination. Other activities may include carpentry, plumbing, or painting, which are all assumed to occur with an elevated level of loose surface contamination.

3.3.2.3 Renovation Scenario –Demolition Workers

The demolition worker scenario is similar to the renovation worker scenario, and many of the parameter values used for the renovation scenario are also used for the demolition scenario. Some differences occur in the values used for the exposure duration and the removable fraction. For this modeling effort, the same model was used for demolition that was used for renovation with certain exceptions. The demolition scenario exposure duration was decreased to account for a shorter term activity, and the removable fraction was increased to account for more loose contamination.

3.3.3 Parameter Listing

Input parameters include case-specific time parameters, building parameters, receptor parameters, source parameters, and radiological units. Input parameters are briefly discussed in the following sections, and values used are summarized and justified in Appendix H, Tables H-1 through H-4.

3.3.3.1 Case-Specific Time Parameters

Case-specific time parameters include two of the three exposure time parameters used in RESRAD-Build. These are the exposure duration and the indoor fraction. Exposure duration is the period of time over which the exposure takes place, and indoor fraction specifies the fraction of the exposure duration that a receptor is inside the building. The third time parameter, time fraction, is receptor-specific and is included with the receptor parameters. These three time factors are used to determine the time a receptor spends at a given location. See Appendix H for values used and justification.

3.3.3.2 Building Parameters

The conceptual building model in RESRAD-Build consists of from 1 to 3 rooms. The Main Building and a portion of the Die Shop (Survey Unit 4) are the only building areas on site that historically included operations with uranium material. A single story room located in Building 1, the area with the highest level of remaining residual contamination, was selected for RESRAD-Build analysis. This room was identified as Survey Unit 1-20 for FSS. The approximate dimensions of the room are 50’ x 50’ x 12’. Construction materials include concrete block walls, a ceiling consisting of horizontal steel beams and metal roof decking, and a concrete floor.

Site specific building parameters including the building area and ceiling height are used in the air quality model contained in RESRAD-Build. To solve the air quality model, an average building air exchange rate was also selected. To solve the deposition model included in RESRAD-Build, a deposition velocity and a resuspension rate were entered. See Appendix H for values used and justification.

3.3.3.3 Receptor Parameters

The receptor parameters identify the exposure characteristics of an individual. For Building 1, the screening groups consist of adult males who work in light industry, renovation workers, and demolition workers. For the model runs, a single receptor was specified. The receptor point was specified according to room, location, and the fraction of time that an individual spends at each location. An ingestion rate and a breathing rate are other required receptor parameters that were provided. See Appendix H for values used and justification.

3.3.3.4 Shielding Parameters

To evaluate the external pathway, information is required about the shielding that exists between the source and the receptor. Shielding characteristics include material type, thickness, and density. For Building 1, it has been conservatively assumed that no shielding will exist since sources are either currently exposed or could be exposed in the future. See Appendix H for values used and justification.

3.3.3.5 Source Parameters

Source parameters include source type, source location, radon release information (if applicable), size, removable fraction, air release fraction, and radionuclide contamination of the source. The ten principal surfaces in the room (Survey Unit 1-20) were identified as sources for the model. These included the floor, ceiling, four upper wall surfaces and four lower wall surfaces.

For dose analysis, it is assumed that each building surface is affected by U-234, U-235, U-238 with an activity ratio of 82%:5%:13%, respectively. This ratio is representative of 5% U-235 enrichment. The enrichment level was chosen somewhat arbitrarily, since this variable does not significantly influence dose. It was also assumed that residual radioactivity is limited to building surfaces.

The analysis assumes a total uranium activity of 1 dpm/100 cm^2 for each source. Assumption of unit activity allows the flexibility of using the results for simple derivation of a guideline value for total uranium, or calculation of dose for direct comparison with the 25 mrem/year guideline value. Derivation

of a guideline value for total uranium would be accomplished by dividing the 25 mrem/year guideline value by the dose resulting from 1 dpm/100 cm^2 total uranium. Alternatively, the dose can be estimated from the unit activity RESRAD-Build simulation by multiplying the resulting dose by the average total uranium activity for the room. The highest activity measurements in the Main Building are associated with the lower surfaces of Survey Unit 1-20, where the measured average beta activity is approximately 228 dpm/100 cm^2 and the measured average alpha activity is approximately 7 dpm/100 cm^2. This data is presented in Appendix D of Westinghouse, 2000g (Report #007).

See Appendix H for a summary of all source parameter values used and justification.

3.3.3.6 Radiological Units

Radiological units were specified for activity and the resulting dose equivalent. See Appendix H.

3.3.4 Results

The RESRAD-Build reports generated for the industrial worker, renovation worker, and demolition worker scenarios are provided in Appendix I. The peak receptor dose due to unit activity for the industrial worker scenario is approximately 0.00042 mrem at time 0. Considering a conservatively high estimate of average total uranium activity of 235 dpm/100 cm^2 for all surfaces in Survey Unit 1-20, the estimated peak receptor dose would be 0.1 mrem/year, which is well below the 25 mrem/year unrestricted release criteria.

The peak receptor dose due to unit activity for the renovation worker scenario is approximately 0.00018 mrem at time 0. Considering a conservatively high estimate of average total uranium activity of 235 dpm/100 cm^2 for all surfaces in Survey Unit 1-20, the estimated peak receptor dose would be 0.04 mrem/year, which is well below the 25 mrem/year unrestricted release criteria.

The peak receptor dose due to unit activity for the demolition worker scenario is approximately 0.0002 mrem at time 0. Considering a conservatively high estimate of average total uranium activity of 235 dpm/100 cm^2 for all surfaces in Survey Unit 1-20, the estimated peak receptor dose would be 0.05 mrem/year, which is well below the 25 mrem/year unrestricted release criteria.

3.4 RESRAD-Build Sensitivity Analysis

Sensitivity analysis was performed using the uncertainty analysis feature in RESRAD-Build. The uncertainty analysis feature in RESRAD-Build is the computation of the total uncertainty induced in the output (dose) as a result of either the uncertainty in or probabilistic nature of the input parameters. It incorporates default parameter distributions based on national average data for the selected parameters. This analysis helps determine the relative importance of the inputs in terms of their contributions to the total uncertainty. The results of uncertainty analyses can also be used as a basis for determining the cost-effectiveness of obtaining additional information on input parameters. To supplement the uncertainty analysis, two additional deterministic runs were conducted to evaluate the effect of varying the removable fraction.

3.4.1 Approach

The case selected for sensitivity analysis was the building occupancy scenario. This case was selected because the dose predicted for the building occupancy scenario was more restrictive than either the renovation scenario or the demolition scenario as concluded from the baseline RESRAD-Build runs described previously.

3.4.2 Source Term

The source term for the uncertainty analysis was assumed to be the same as that modeled in the baseline evaluation described above.

3.4.3 Parameters of Interest

Several input parameters used in RESRAD-Build dose assessment are inherently uncertain or probabilistic in nature. These parameters include those for which RESRAD-Build has established probabilistic analysis default distributions. These uncertain or probabilistic parameters are summarized in Table 3-2 and have been identified as the parameters of interest for uncertainty analysis for the WSMP Facility. Uncertainty analysis was performed on each of the listed parameters to assess the relative importance of these input variables in influencing the output of RESRAD-Build dose assessment.

Table 3-2: Parameters of Interest.

Parameter	Fortran Name	Probabilistic Analysis Default Distribution	Definition
Deposition velocity	UD	Loguniform	Indoor deposition velocity of contaminant particles in the building air.
Resuspension rate	DKSUS	Loguniform	Rate at which the deposited material is resuspended in the air per unit time.
Air exchange rate	LAMBDAT	Lognormal-n	Total volume of air in a building or room replaced by outside air per unit time.
Receptor breathing rate	BRTRATE	Triangular	Rate at which the exposed individual inhales air while at the specific receptor location.
Indirect ingestion rate	INGE2	Loguniform	Ingestion rate of deposited material for a receptor at a specified location inside a building. This rate represents the transfer of deposited contamination from building surfaces to the mouth via contact with hands, food, or other objects.
Air Release Fraction	AIRFR	Triangular	Amount of the contaminated material removed from the source that is released into the air in the respirable particulate range.
Source Lifetime	RFO	Triangular	Time over which the removable part of the source is (linearly) eroded.

Removable fraction was also identified as a parameter of interest. The effect of increasing the removable fraction was evaluated by performing two additional deterministic RESRAD-Build model runs. For these runs, values of 5% and 10% were selected for evaluation. The 5% value was selected for evaluation because it represents a moderate level of removable contamination. The 10% value is the RESRAD-Build default value for this parameter, and it represents a conservatively high estimate of removable contamination that might be present after remediation.

3.4.4 Input Parameter Listing

Input parameter values used for the sensitivity analysis baseline run and subsequent uncertainty runs are the same as those used in the baseline runs described above. Input values are summarized in the Appendix H tables.

3.4.5 Results and Discussion

The RESRAD-Build Code was used to perform the following analyses:

- Eight individual uncertainty analysis runs that address each of the parameters of interest identified in Table 3-2 (Appendices J1 through J7)

- One uncertainty analysis run that considered the uncertainty of all the parameters listed in Table 3-2 (Appendix J8)

- Two additional deterministic runs that were used to evaluate the sensitivity of the removable fraction input parameter (Appendices J9 and J10)

3.4.6 Uncertainty Analysis

3.4.6.1 Statistical Information

Table 3-3 presents the results of the uncertainty analysis in a statistical format in terms of the minimum, maximum, average, and 95th percentile dose values for each parameter of interest evaluated separately. In addition, statistical information is presented for a run in which all the parameters of interest listed in Table 3-2 were subject to uncertainty analysis. These results can be compared with the dose determined for the baseline deterministic run, which was 4.17E-04 mrem for Time 0.

Table 3-3: Dose Statistics for Evaluation Time 0 Years

Parameter Subject to Uncertainty Analysis	Fortran Name	Minimum Dose (mrem)	Maximum Dose (mrem)	Average Dose (mrem)	95th Percentile Dose (mrem)
Deposition velocity	UD	4.18E-04	4.20E-04	4.18E-04	4.20E-04
Resuspension rate	DKSUS	4.18E-04	4.96E-04	4.25E-04	4.63E-04
Air exchange rate	LAMBDAT	1.19E-04	3.68E-03	5.69E-04	1.44E-03
Receptor breathing rate	BRTRATE	2.18E-04	5.29E-04	3.88E-04	4.94E-04
Indirect ingestion rate	INGE2	4.18E-04	4.19E-04	4.18E-04	4.19E-04
Air Release Fraction (Source 1)	AIRFR	3.10E-04	6.04E-04	4.18E-04	5.51E-04
Source Lifetime (Source 1)	RFO	4.43E-04	4.90E-04	8.46E-05	1.74E-04
All Parameters Listed in Table 3-2	See above	1.09E-04	4.31E-03	4.55E-04	1.18E-03

From Table 3-3, it is apparent that dose is most sensitive to the air exchange rate, and dose is relatively insensitive to the remaining parameters. Further insight is gained from the scatter plots.

3.4.6.2 Cumulative Probability Plots and Scatter Plots

The cumulative probability plots and scatter plots are presented in Appendices J1 through J8 along with the reports generated from the uncertainty analysis for each parameter of interest and for the case where all parameters of interest were subject to uncertainty analysis. The scatter plots are also useful in determining the inputs that have a significant influence on the output. Table 3-4 summarizes observations regarding scatter plots.

Table 3-4: Scatter Plot Evaluations

Parameter	Fortran Name	Comment on Scatter Plot
Deposition velocity	UD	Dose is relatively insensitive to variations in this parameter.
Resuspension rate	DKSUS	Dose is relatively insensitive to variations in this parameter.
Air exchange rate	LAMBDAT	Significant dose increase at low air exchange rates.
Receptor breathing rate	BRTRATE	Wide range of potential breathing rates accounts for variation in dose.
Indirect ingestion rate	INGE2	Dose is relatively insensitive to variations in this parameter.
Air Release Fraction	AIRFR	Wide range of potential air release fraction values accounts for variation in dose.
Source Lifetime	RFO	Dose is somewhat sensitive at low source lifetime values.
All Parameters Listed in Table 3-2	See above	Significant dose increases at low air exchange rates are suggested by the LAMBDAT scatter plot.

3.4.7 Removable Fraction Evaluation

Results of the removable fraction parameter evaluation are presented in Appendices J9 and J10 and summarized in Table 3-5.

Table 3-5: Removable Fraction Evaluation

Filename	Removable Fraction	Dose (mrem)
Blairsville Building Occupancy.bld	0.022	4.17E-04
Blairsville Building Occupancy RF05.bld	0.05	9.29E-04
Blairsville Building Occupancy RF10.bld	0.1	1.84E-03

The dose is sensitive to the value used for removable fraction for the building occupancy case.

3.5 Conclusions Regarding Site Buildings

Investigation and remediation of the site buildings has been thoroughly documented. Areas of radiological concern in the site buildings included piping and associated soils underneath Building 1, Roof areas on Buildings 1 and 4, and building surfaces in Building 1. Each of these areas was thoroughly investigated and the final radiological status of each has been well documented demonstrating that these areas meet the criteria for unrestricted release that have been established for the site. RESRAD-Build modeling conducted by ENERCON confirmed that the annual dose expected for a member of the public is well below the release criteria of 25 mrem per year. On the basis of these findings the site buildings at the WSMP are considered suitable for release for unrestricted use.

4.0 Radioactive Waste Shipment and Disposal

Radioactive waste shipment and disposal records associated with WSMP decommissioning activities are provided in Appendix B. WSMP sent 36 shipments of material to Envirocare of Utah, Inc. (Envirocare) Clive Disposal Site between September 1997 and December 2001. These shipments were documented on Radioactive Waste Shipment & Disposal Records # 0674-04-01 through 0674-04-036. In addition, one shipment of mixed waste (Manifest # 99119) was sent to Diversified Scientific Services, Inc. in Kingston, TN in November 1999.

One of the Envirocare shipments was returned to WSMP and later reshipped. Shipment #0674-04-018 dated November 21, 1997 was originally rejected for disposal by Envirocare, returned to WSMP and later reshipped to Envirocare for disposal as Shipment #0674-04-022 dated December 11, 1997. According the records, the shipment consisted of 56 drums and 13 overpacks. The shipment contained soil that came primarily from excavation in the FZBA. Upon arrival of the shipment at Envirocare, checks were performed to verify conformance to the profile and ranges for pH, oxidation/reduction, cyanide, sniffer (organics) and sulfide. The checks revealed that the material as shipped was non-conforming due to exceedances of the sniffer test.

As a result Envirocare rejected the shipment and Westinghouse was required to authorize the shipper to return the shipment to WSMP, where it would remain until such time as Westinghouse was able to rectify or explain the variance. Envirocare also collected a sample of the soil and submitted it for TCLP analysis for organics. It is important to note that the results of the analysis did not indicate any volatile organic materials.

Upon review of the origin of the soils, it was noted that high amounts of organic material, such as grass, etc., were included with the soil that had been collected and placed in the 55-gallon drums. During the time of storage, the organic matter likely decomposed, and without ventilation, the decomposition products accumulated in the drums. When the lids were removed and a sniff test was performed, the sampling equipment indicated the exceedances of the acceptance range. Westinghouse provided an explanation to Envirocare. Considering this explanation along with their analytical results, Envirocare ultimately accepted the material and issued a revised notice of transport for Waste Stream 0674-04, increasing the range of acceptance of the sniffer test.

The shipment was re-manifested as 0674-04-22 and transported to Envirocare in the middle of December 1997. Upon arrival at Envirocare, the material was rechecked and results were compared to the ranges of acceptability. The shipment was found to meet the criteria. The shipment was accepted by Envirocare and disposed.

5.0 Conclusions

In 1994, Westinghouse began a process of conducting detailed radiological surveys of the site and conducting remediation as necessary in order to assure the site meets the applicable criteria for unrestricted use. The focus of the early radiological investigations was broad so that the entire site was considered. Subsequent investigations were more narrowly focused to consider only the areas of radiological interest, and remediation activities were ultimately performed in limited areas of the site grounds and site buildings. Groundwater sampling indicated the presence of only naturally occurring radionuclides.

Early investigations of the site grounds identified the Northeast Fill Area, the Former Pond Area, the Casting Sand Mound, the Quarry Area and the FZBA as areas of radiological interest. Each of these areas was systematically evaluated, and only the Quarry Area and the FZBA were ultimately identified as requiring remediation to meet unrestricted release criteria. The Quarry Area was thoroughly vacuumed leaving the area nearly devoid of soil material and zirconium fines. Final gamma walkovers confirmed that the Quarry Area achieved unrestricted release criteria. Extensive remediation activities were also conducted in the FZBA after it was determined that concentrations of uranium in soil exceeded unrestricted release criteria. In this case contaminated soil and demolition debris was excavated from the area and disposed off-site at appropriately licensed facilities. The final status survey documented in B. Koh, 2001b confirms that the FZBA met unrestricted release criteria. RESRAD modeling conducted by ENERCON confirmed that the annual dose expected for a member of the public is well below the release criteria of 25 mrem per year. On the basis of these findings, the site grounds at the WSMP are considered suitable for release for unrestricted use.

Investigation and remediation of the site buildings has also been thoroughly documented. Areas of radiological concern in the site buildings included piping and associated soils underneath Building 1, Roof areas on Buildings 1 and 4, and building surfaces in Building 1. Each of these areas was thoroughly investigated and the final radiological status of each has been well documented demonstrating that these areas meet the criteria for unrestricted release that had been established for the site. RESRAD modeling conducted by ENERCON confirmed that the annual dose expected for a member of the public is well below the release criteria of 25 mrem per year. On the basis of these findings the site buildings at the WSMP are also considered suitable for release for unrestricted use.

6.0 References

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